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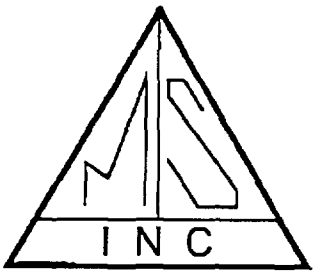

Management Sciences, Inc.

Contract Number: N68335-00-C-0139

"Web Based Client/Server Interface for Part Task Training"
Commanding Officer
Indian Head Division
101 Strauss Ave.
Naval Surface Warfare Center
Indian Head, MD 20640-5035
Attn: Mr. Terry Margeson Code 8210C
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Phase I

FINAL REPORT

June 15, 2000

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This is the Phase I final report for a NAVAIR SBIR project to develop and commercialize web-based Collaborative Part Task Training (CPTT). The Navy has fielded many Part Task Trainers (PTT) that emulate a variety of aircrew Control Display Units (CDUs). These CDU Emulations (CDUEs) reflect unique Operational Flight Program (OFP) functionality for specific types of aircraft. The objective of each CDUE is to provide aircrew training using a man/machine interface that is representative of the aircraft. This project explored the potential of using the Internet to revolutionize the way the Navy provides part-task proficiency training. The project focused on developing concepts for ways to use the Internet to provide individual and cooperative Distanced Part Task Training using virtual or real training equipment. The Phase I goal was to define a commercially viable multi-media virtual training environment for providing realistic training wherever and whenever needed.

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1. Executive Summary

This is the Phase I final report for a NAVAIR SBIR project to develop and commercialize web-based Collaborative Part Task Training (CPTT). The Navy has fielded many Part Task Trainers (PTT) that emulate a variety of aircrew Control Display Units (CDUs). These CDU Emulations (CDUEs) reflect unique Operational Flight Program (OFP) functionality for specific types of aircraft. The objective of each CDUE is to provide aircrew training using a man/machine interface that is representative of the aircraft. This project explored the potential of using the Internet to revolutionize the way the Navy provides part-task proficiency training. The project focused on developing concepts for ways to use the Internet to provide individual and cooperative Distanced Part Task Training using virtual or real training equipment. The Phase I goal was to define a commercially viable multi-media virtual training environment for providing realistic training wherever and whenever needed.

Our SBIR work plan, consistent with the proposed schedule/POA&M, was as follows:

Research	Dec 1999 – Jan 2000
Systems Engineering	Jan 2000 – Feb 2000
Design Prototype	Feb 2000
Phase II Support	Feb 2000 – Apr 2000
Quick Look Final Report	15 Apr 2000
Phase II Test Plan	Apr 2000
Demonstration	Apr 2000 – May 2000
Final Report	May 2000

Navy Sponsors

The CPTT environment has gained the enthusiastic support of several NAVAIR and NAVSEA program managers. In particular, we have been assured support of Phase II and Phase III deployment from PMA299, PMA205, NAWCTSD, and NAVSEA. These programs will be beta sites during Phase II to assure that the CPTT tools and services meet Navy requirements. Some CPTT beta sites will be at NROTC, naval reserve units and aboard Navy ships connected to instructors aship and ashore. Lockheed Martin will provide access to PTT instructor systems in Albuquerque.

Commercialization begins with NAVAIR, Navy, and other government users. Our primary objective in Phase II will be to complete authoring of a very capable web-based workstation that will be installed, tested and evaluated at NAVAIR designated beta sites.

Phase II Functionality

We envision that the Phase II Collaborative Part Task Training (CPTT) environment will include the following functionality:

- administrators using virtual office tools to manage PTT devices and student affairs.
- security services protect personal and training sensitive data.
- instructors collaborating to prepare high quality, high fidelity training materials.
- students using the Internet to select, access and use training materials.
- students interacting with distanced instructors and participating team members both asynchronously and in real time.
- multiple students participating in cooperative and team training.
- instructors using Sentient processors to set-up custom part task training.
- instructors using Sentient processors to monitor student activity.
- instructors scoring individual and team progress in meeting training goals.
- instructors reviewing "instant replays" to review the training experience.

Commercialization Potential

The CPTT environment can be used in nearly any area of competency training and testing for specialty occupations. In particular, the technology can be used to cost effectively train and certify aircrews and support personnel in a manner that was formerly considered impractical or impossible. The training can be performed anywhere there is Internet access, e.g. on ship, on shore, and aboard aircraft in training missions. We have teamed with Advanced Rotorcraft Technologies and Lockheed Martin Simulators Division to develop and commercialize the products.

2. Summary of Phase I Accomplishments

The overall objective was to develop a generic collaborative network PTT management system that applies to all types of PTT, but especially those for Navy aircraft. Emphasis was placed on PTT for joint exercises with not only Navy aviators but also Air Force, Army, and friendly foreign forces.

In Phase I, we met or exceeded all of our technical objectives. In addition to meeting our stated objectives, we found enthusiastic support for the concept, and partners that will help us follow through to Navy and industry commercialization. This is important because it is virtually impossible to continue to Phase II without endorsement from potential users of the Phase I concept. Indeed, perhaps our most important accomplishment is that we will get support letters from NAWCAD, PMA 299 H-60 and most probably will also get funds for support study contracts NAWCTSD, US Coast Guard, US Naval Reserve, STRICOM and NAVSAFCEN. This also assures beta sites to test the CPTT toolset and processes in preparation for Phase III.

The technical objectives stated in the Phase I proposal of this SBIR were:

a) Research into the internal hardware and software methods of the H-60, T-45, P-3, and other CDUE for managing the servers and computers;
b) System engineering to develop the requirements document for the server/client software;
c) Developing of a prototype fusing data and multi-media from networked collaborators using a mix of PC programs including flight simulator software programs; and
d) A feasibility demonstration of the prototype showing that the methodology will probably work with a range of CDUE, and in particular the H-60 and P-3 CDU.

Our intent was to show how CDU hardware and CDUE software can be modified to host and support an embedded network communication application in a client/server mode transparent to the use. We developed a working prototype that convincingly showed that the methodology applies to in-service CDU. We accomplished all of our Phase I Objectives stated in the Phase I proposal.

Prototypes

The project team wrote software to build a prototype CPTT environment built from low cost Commercial Off The Shelf (COTS) hardware and software. Our software solution for collaborative Internet-based instruction is based on over thirty months developing collaborative virtual team environments under a NAVAIR SBIR project. The commercialized product from that SBIR, VTeamWare was used to rapidly prototype the basic Internet collaboration environment. Using simulation software from Advanced Rotorcraft Technologies, the prototype included the ability for a student to download, practice, record, and upload the results of an emergency procedures training scenario.

We demonstrated the feasibility to perform distanced PTT using PilotStation® and VTeamWare™ to NAWCTSD on April 20. We showed a student requesting a PTT, downloading the PTT, accessing a multi-media instructor briefing, and running the PTT in PilotStation. We demonstrated the feasibility for the interface to provide scheduled and unscheduled PilotStation-to-server and server-to-PilotStation data transfers in a background mode. Further, we did this in such a way as to assure that the H-60 aircrew interface remains aircraft representative during all modes of training operations. We demonstrated an even more capable web-based virtual training facility to PMA299, PMA205, and several other NAVAIR and OPNAV organizations on May 22-23.

3. Background

CDU Emulations (CDUEs) reflect unique Operational Flight Program (OFP) functionality for specific types of aircraft. The CDUE provide a panoramic view projected on screens that immerse the student in a very realistic cockpit. Each CDUE is very expensive, and requires that the students travel to training sites. This situation is expensive, and limits participation only to those fortunate enough to have budgets that provide for off-site training.

The Navy plans more and more use of flight simulators to save on the expense of real flight training. There is a real goal to use PC-based flight simulators for much of the training to reduce costs associated with dedicated training on the CDUs. At the same time, the DoD is focusing on collaborative engagements with joint multi-aircraft of several types. This includes joint service missions, NATO missions, and new missions with collaborative action wherein a pilot controls several unmanned vehicles. Today's PTTs are hosted on CDUEs that are stand-alone systems under full control of a single trainee, or a trainee and a co-pilot. This does not easily lend itself to collaborative team training, or to combat mission training with inputs from other students flying friendly aircraft in team missions. Collaborative training means facilitating the interactions between instructors and students in a geographically distributed environment. The instructor and student are not required to be colocated. The collaborative methodology will also let instructors "fly wing" to either assist in cooperative flight tasks, or inject faults into the CDUE.

Sentient Sensors

Sentient Sensors are tiny web-enabled sensory devices for measuring and monitoring situations. A key innovation in this Phase I SBIR is the incorporation of these smart sensing devices into both PTT development and deployment. Sentients are capable of monitoring 'real world' conditions in aircraft for incorporation in PTT development.

Sentients are also capable of monitoring student reactions and performance to validate PTT training. Sentients:

- Monitor student reactions, body movement, heart rate, etc.
- Monitor switches, dials, and other physical objects.
- Govern action timing.
- Record events.

Current Sentient Sensor programs:

- Were tested in H60.
- Have been validated of dynamic interface parameters.
- Are in Phase III to deploy in H60, P3, F14
- Are developing next generation flight data recorder for prognostic health management.

The Innovative Opportunity

Management Sciences, Inc, (MSI) proposed a unique and innovative approach to a hardware/software solution to address distributed instructor/student interaction. Additional capabilities will be included to enable real-time participation between multiple instructors and students. The Internet can be used to facilitate networking low cost, distributed CPTT using a virtual training facility. We also envisioned using low-cost postage-stamp size "Sentient" nanocomputers to perform the necessary switch settings, sensoring, signal processing and Internet communications to a remote server. This work will provide a way to use the Internet for Partial Task Training as a precursor to fully cross-linked CDUE. At the same time, the technology will enable a global approach for initial Part Task Training, and re-certification Part Task Training at home, at reserve bases, and aboard ships. There is a vast and emerging commercial market for the same technology for commercial aircraft and adapted for other high technology systems such as ships, mass transit systems, process plants, and manufacturing plants.

The following summarizes our innovation opportunities.

- PTT downloads from web database from central library.
- PTT upgrades on demand.
- Self education or mentored training.
- Instant replay for instructor evaluation.
- Web-enabled multi-person collaborative training.
- PTT training graphical history and results database.
- Sensoring of trainers and trainees, if needed.
- Platform and instrument training.
- Security.
- Positive identification of instructor and trainee.

4. MSI CPTT Phase I Team

In Phase I, MSI formed a team with Advanced Rotorcraft Technologies, developer of the FlightLab PilotStation simulator. We issued a subcontract to ART to develop the interface to establish and demonstrate the proof of principle of using ART with VTeamWare. We enlisted the gratis support of the Honeywell Defense Avionics Systems Division (DASD) for technical expertise on HLA simulation, and technical expertise for hardware integration, bus issues, etc. DASD will also be a good source for definitions of cockpit avionics failure modes for instrumentation emergency procedures training. We were also supported by the Lockheed Martin Simulator Systems Division located in Albuquerque to advise on emulating instructor stations and interfaces to full up PTT systems used at simulator facilities. These firms will be solicited to participate in Phase II.

5. Phase I Research

The goals of the research in Phase I, stated in the proposal, were to "perform research into the internal hardware and software methods of the H-60, T-45, P-3, and other CDUE for managing the servers and computers." Initially, the research concentrated on understanding the different perceptions and definitions of Partial Task Training (PTT).

We started our project by meeting with Mr. Terry Margeson, our contract manager. Terry covered his understanding of the need for Internet based PPT and set up interviews with PMA205. The work plan was concurred to at the Phase I Kick-Off Meeting on 3 Dec 1999.

We gathered the OPNAV perspective on current/future program and funding, worked with the NAWC-TSD and NAVAIR T/M/S trainer experts in Orlando and PAX to open insertion opportunities in present and future trainer environments. We were particularly enthused about relationships developed with Fleet POCs to understand perceived PTT deficiencies, OAG Trainer Deficiency Reports and thoughts on utility of a Collaborative Partial Task Trainer network.

We explored the spectrum of Navy trainers from stand-alone desktop trainers to high fidelity, full vision/motion Weapon System Trainers. We narrowed our focus to PTTs. The PI contacted OPNAV 889F, NAWC-TSD, DMSO/OPNAV N6M, FA-18 SYSCOM/FLEET, Manned Flight Simulator (MFS), and NAVAIR.

Our Phase I effort has focused on three primary components. First, many hours have been dedicated to determining the scope and definition of Part Task Training (PTT) efforts within the Navy. The responses that we have received from the Navy have been varied, with no single definition of Partial Task Training being broad enough to fit the variety of Navy PTT efforts that we have encountered. The second focus of our Phase I efforts has been to define an approach to Internet Client / Server based Collaborative Part Task Training (CPTT) that has value across the breadth of Navy PTT programs. The third component of our Phase I effort has been to construct a prototype collaborative computer software environment for CPTT, including a preliminary integration with a desktop trainer.

In order to design an effective Part Task Training interface unit, we investigated current platforms, Fleet needs and future design compatibility. We found that the HLA (Higher Level Architecture) required by DoD will eventually need to be addressed and could become an excellent Option to this contract.

We identified Fleet user/OAG current PTT deficiencies and desired improvements. We made contacts with OPNAV 889F, FA-18, NAWC-TSD, and Manned Flight Simulator. We talked to OPNAV Resource Sponsors to identify current and future dollar allocations and confirm the funding stream for Navy trainers. We contacted the OPNAV 889/TMS Class Desks. We fully investigated DoD simulator standards (HLA) and current applicability to this project through Phase II. Advice came from DMSO and NUWC/OPNAV N6M.

Throughout the course of the contract we visited NAVAIR at Patuxent River NAS PMA headquarters as well as two visits to NAWCTSD in Orlando, and visits to Lockheed Martin Simulator Division and Honeywell Avionics Systems Division. We also visited with staff at OPNAV-889 and NAVSEA in Crystal City, VA, NAVSAFCEN in Norfolk, VA, and the Coast Guard ARSC in Elizabeth City, NC. Persons at each site see the use of the Internet for PTT as the next generation of instruction. The major interest was in improving the quality of specialty training while dramatically reducing costs and scheduling of training resources.

In early January and again in March MSI met with Dr. Dean Carico, manager of rotary aircraft simulator software development at NAWCAD to enlist his help in understanding how the Navy views the use of the Internet for partial task training of helicopter pilots. Dr. Carico was particularly interested in how sensors could accurately determine the degree of physical activity that is experienced by the student pilot in training. Currently, there is not a convenient way to add sensors unobtrusively to gain the feedback that would help to assess the fidelity of the training. For example, the work effort of the student in making control stick and pedal movements.

Sensored PTT

Our research extended to use of all types of PTT such as stores management, maintenance, contract management, weapon handling and ship navigation. Many persons we interviewed expressed an intense interest in web based sensored PTT to provide more realistic training in using high tech weapon systems. We found a particular interest at NAWCTSD in using sensors to ensure that students actually experience workloads required for performing difficult tasks. NAVSAFCEN expressed interest in sensored PTT training for surviving safety situations that simply cannot be duplicated in normal training circumstances. For example, NAWCTSD saw an opportunity to have aircrew use the web-based PTT prior to going to school for certification. In another example, sensored PTT for training fire fighters, data from sensors worn on clothing would be relayed by the web to instructors to assure reality and compliance with OSHA regulations. We found additional interest in using our technology to bring H-60 PTT proficiency training directly on board ship for aircrews and maintainers. The same technology can be used to support PTT needs of foreign military users of the H-60.

We developed our knowledge on the various types of Navy PTTs, current PTT deficiencies, Fleet user desired improvements, prognosis of funding/development by resource sponsors, DoD simulator standards and the future concepts and designs by simulation designers. As expected, our findings identified significant differences in how the various T/M/S view PTTs. Research found that the new H-60R is the best fleet platform model for our PTT interface development.

Opportunities for Technology Insertion

In our research, we visited with leaders in training activities at Navy sites. We found tremendous potential for commercialization of web based PTT, not only for the Navy but for worldwide commercial situations. This is largely made possible because of the change of instruction to a web-based paradigm (e.g. university studies). Today it is accepted practice to use a web e-commerce toolset that would have been impractical a few years ago. For example, we found interest in using our technology to bring H-60 proficiency PTT directly onboard ship for aircrews and maintainers. The same technology can be used to support PTT needs of foreign military users of the H-60. Although the collaborative network based concept for MSI's CPTT is not platform specific, MSI has chosen the H-60 as the example for Phase I for a variety of reasons: the H-60 is the most widely used helicopter within DOD; MSI is currently working on sensoring an H-60; and the advent of the H-60R will generate new PTT requirements.

6. Phase I System Engineering

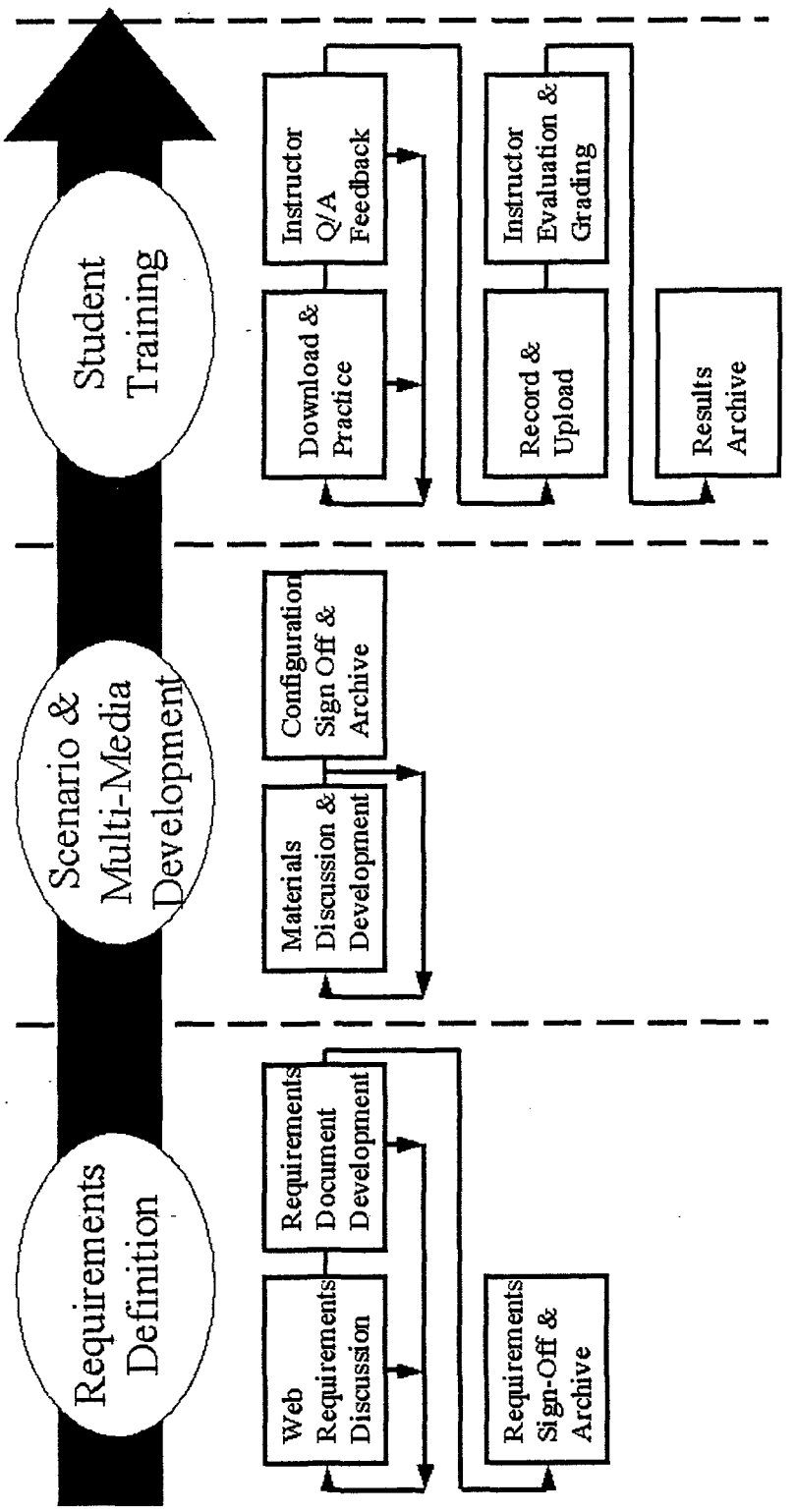
The goal stated in the Phase I proposal was to "perform system engineering to develop the requirements document for the server/client software". To do this, we mapped out the MSI approach and solution to create an Internet-based interface enabling a stand-alone distributed PTT environment to interact with a remote instructor and with other trainers not at the same location. We identified requirements for future Navy trainers, in general, and PTTs, in particular, and we are going with the goal to establish designer/contractor relationships and ensure Collaborative PTT concepts are compatible.

Requirements Definition

Our system engineering determined near term requirements for use of web-based distributed PTT in order to locate sponsors for Phase II development and beta sites to prepare for Phase III technology insertion. We found their requirements centered on having PTTs that have ease of use, fidelity, and low cost and that can be used wherever students are located, especially at operating sites and at sea. PMA299 is interested in developing a suite of PTT tasks and scenarios relating to the new H-60 cockpit, new missions, and new equipment such as the Advanced Low Frequency Sonobuoy (ALFS) and the Towed Mine Countermeasure Sled (TCMS). There is also a real opportunity for using the CPTT for training for the H-60 Joint Shipboard Helicopter Interoperability Process (JSHIP) wherein Navy maintainers will work on Army H-60 Blackhawks, Navy Officers on Deck will work with Army H-60 pilots, and Navy weapons specialists will work with Army weaponry.

In our second month (February), we authored a document describing requirements and a virtual flight instruction facility architecture.

Collaborative PTT Deployment Process Definition



Requirements of Potential Navy Sponsors

We found several opportunities for Phase II sponsorship. We have found sponsors at H-60 and Navy Flight Test Center at Patuxent River NAS. The CPTT environment has gained the enthusiastic support of several OPNAV, NAVAIR and NAVSEA managers. In particular we have been assured support of Phase II and Phase III deployment from PMA299, PMA205, NAWCTSD, STRICOM and NAVSEA. These programs will be beta sites during Phase II to assure that the CPTT tools and services meet Navy requirements. Some CPTT beta sites will be at Naval Reserve units and on board Navy ships connected to instructors both aboard ship and ashore. Lockheed Martin will provide access to PTT instructor systems in Albuquerque. We identified and actively pursued possible candidates for letters of endorsement of a Phase II contract award.

7. Phase I Prototyping

The goal for prototyping stated in the Phase I proposal was: "developing a prototype for fusing data and multi-media from networked collaborators using a mix of PC programs including flight simulator software programs"; and "initial expanding of the H-60 CDUE functionality using server connectivity to networked collaborators with an embedded data transfer interface."

Our software programmers wrote C++ and JAVA middleware and some application-specific JAVA programs to create the prototype architecture developed by system engineering. The purpose was to demonstrate feasibility of using the Internet as a virtual training facility with multi-media instruction and the interface and use of the ART PilotStation® workstation software. The use of COTS, like our VTeamWare™ for collaborative networks, allowed us to create a very believable functional CPTT environment and software.

ART FlightLab & PilotStation

PilotStation® was a natural fit with our focus on Navy helicopters. It required affordable modifications to provide an impressive Phase I demonstration that capitalizes upon MSI's Phase I work effort. MSI and ART discussed the details of these enhancements, including a subcontract funding for the ART work effort. ART provided the work as a proposal effort for a joint Phase II proposal.

ART provided a copy of the PilotStation® H-60 simulator. MSI has spent some of our Phase I funding to purchase computer hardware capable of running the simulator. This acquisition provided a smooth path to demonstrations to the government at the end of our Phase I effort.

ART encouraged MSI to provide an interface between HLA simulation and the BBS architecture as a component of our Phase II effort. All simulation environments acquired by the government after the year 2000 will be required to provide this interface. An evaluation of including a HLA technology interface is described in this report. The work will be incorporated in the Phase II proposal.

Under Phase I, MSI and ART are developing an operator/instructor console for PilotStation® that can read files describing test scenarios and write output data to files that can be used to replay a test run. The Phase I demonstration loads a prepared file describing the desired test scenario, for example failing an engine at a specified time, which causes the student to initiate an auto rotation to a designated landing site.

The data required to replay the student's response to the engine failure is recorded in an output file and a "Replay" mode in the instructor console reproduces the student's test run for evaluation by the instructor. In the Phase I demonstration, there is no direct link between the collaborative environment and PilotStation®. The two programs are run separately to exchange files and conduct the training session.

Prototype Demonstration

The feasibility prototype was demonstrated showing PTT functions in an Internet server (interactive training) mode. Features of the prototype demonstrated in Phase I:

Internet Client / Server access: The Phase I demonstration at PMA205 was presented using a prototype Internet collaboration environment. All data files used in the demonstration was interactively uploaded and/or downloaded from the Internet.

Collaborative Training Database: The focus of the demonstration presentation was to illustrate the feasibility of an Internet database capable of storing many training scenarios, including Just-In-Time mission scenarios, for real-time access from a student computer.

Collaborative Training Requirements Analysis: The first interactive element of the demonstration showed using the MSI VTeamWare software to create and review action items related to developing an autorotation emergency procedure-training scenario.

Collaborative Training Development : This interactive step illustrated using the MSI VTeamWare software to manage action items and calendar deadlines related to the development of simulation software configuration files and multimedia pilot briefings for an autorotation training scenario.

Multi-Media Training Attachments : This interactive step illustrated the process a student uses to download and view a pilot briefing video from the Internet database.

Student Training : This interactive step illustrated the process that the student uses to download the PTT software configuration files.

Recording Student Results : This step illustrated the process that the student uses to record the simulation activity and the steps required to upload the replay file for later instructor evaluation. This step was not interactively demonstrated due to time constraints during the demonstration.

Collaborative Instructor Review : This interactive step illustrated downloading a replay file from the Internet, replaying the students simulation, and reviewing the student's performance.

Student Scoring : This interactive step illustrated entering the students score into an Internet database, and viewing a chart representing trends in previous students results.

8. Benefits Summary

1. Improved quality and flexibility of PTT instruction, with initial emphasis on aircrew and aircraft maintenance training.
2. A low cost hardware and software solution to quantitatively measure student performance along with instructors' qualitative assessments. Based on Measures of Evaluation (MOEs) and Measures of Performance (MOPs) established by Navy responsible training organizations, MSI will incorporate non-invasive sensors in PTTs and on students to collect metric data during training for immediate feedback to both instructors and students.
3. Intelligent software agents capable of evaluating quantitative performance metrics to provide qualitative insight into student performance. Using artificial intelligence techniques, these software agents will recommend additional focused training tasks that will improve the student's future performance.
4. Dramatically reduced costs associated with PTT hardware and courseware by providing a collaborative Internet or LAN network that can be easily adapted to the existing wide variety of PTTs. Achieving this goal will mean that necessary changes to PTTs can be more easily and cost effectively implemented.

Cost Savings / Cost Avoidance for Navy PTT Needs

Using MSI's CPTT to support Navy Part Task Training needs will result in considerable cost savings and, in some instances, cost avoidance. MSI's CPTT will have an initial acquisition cost under $20K/system for the first year. Licensing costs are directly proportional to the number of licenses needed; although discounts due to quantity are apropos. Each system can easily accommodate up to 50 users (seats) and can easily be expanded to accommodate the number of users needed by any responsible training office. MSI's CPTT approach is Internet or LAN (deployed ship) based. Existing hardware and software can be interfaced to MSI's VTeamWare, avoiding acquisition costs other than those associated with integrating VTeamWare with existing PTTs. Since MSI's CPTT approach is not platform specific, the only cost associated with changing from one platform to another would be the minor amount of programming required to develop the interface between VTeamWare and the new platform.

Acquisition Lead-Time

By the end of Phase II/III of this SBIR, development of the MSI CPTT capability will be complete. Consequently, acquisition lead-time will be very short. The VTeamWare product will be available as COTS, so the only delay will be the short amount of time it takes to construct the interface between VTeamWare and the desired and/or existing platform PTTs. If the needed application has already been developed for another DOD responsible training office, then the acquisition lead-time would only be as long as it takes the administrative tasks to be completed.

COTS Hardware and Software

Development costs and time are minimized because the MSI CPTT is based on COTS hardware and software. The only development effort is integrating VTeamWare with the needed platform PTTs. It is of importance to note that each interface needs only to be developed once. Using the H-60 as an example, since it is the most widely used helicopter in DOD, once an interface for a model specific PTT is developed it can be applied across DOD. Additionally, Sentient sensors and instrument controllers will be fully developed (under other programs) at the completion of this SBIR. They will be available for insertion into the students and training stations.

Ship/Shore Collaborative Network Capability

MSI's CPTT approach is based on establishing collaborative networks. These networks can use the Internet (world wide) or a LAN (deployed ship). Although the MSI approach is focused on using the Internet, it can easily be adapted to using a ship's LAN, or even a hybrid of using a ship's LAN as well as a satellite link to the Internet. The MSI CPTT could easily be the connectivity application for the upcoming Deployed Tactical Air Training System (DTATS). It could collaboratively link an F/A-18 cockpit with the CIC, as well as H-60, E-2C, and E/A-6B cockpits. It could be exercised in a variety of ways by making any of the participants the "central" element. Having this capability onboard a carrier would mitigate, for example, F/A-18 aircrews' lack of "weaponeering" or "buttonology" practice due to lack of flying time while deployed. With the ability to practice "buttonology", F/A-18 aviators could avoid being behind the aircraft at launch.

Platform Flexibility

As mentioned before, MSI's CPTT approach is not platform specific. This is an important characteristic. Once an interface has been developed for a particular platform PTT, that PTT can be integrated into MSI's VTeamWare collaborative network software at will. This means that a CPTT system can be reconfigured very quickly to meet changing training needs. Another aspect of this flexibility is that one CPTT system can be used to satisfy multiple PTT needs.

Deployment Flexibility

The MSI CPTT can be deployed in several ways. It was originally designed to use the Internet for connecting instructors and students; however, it can be employed on a LAN, on a deployed ship for example, or on a LAN with a satellite connection to the Internet. Consequently, one MSI CPTT system can be utilized to meet a number of PTT needs in a variety of deployment modes.

9. Commercialization Potential

MSI has been developing, marketing and selling commercial software since 1976. The historical MSI approach is to partner, collaborate, integrate and innovate. We intend to follow this approach again for a PTT Phase II. Most recently MSI has been successful in getting Phase III funding for VTeamWare™ as a follow on to the successful Phase II NAVAIR SBIR supported by PMA299 and other Navy organizations.

The H-60 PMA was selected for the following reasons:

1. PMA needs a mid-range capability, single mission, desktop PTT. This level of capability is fairly representative of other Navy PTTs and Distributed Learning units.
2. The requirements for the H-60R PTT is still under development (goes out for bids Fall '00). This increases the likelihood that minor system changes (brought about by this SBIR) could be incorporated to provide complementary or exemplary as the Phase III contract.
3. PilotStation is an excellent representative H-60 desktop trainer (SBIR developed) for our feasibility demonstration.
4. MSI has established good relationships with H-60 NAVAIR representatives, Fleet units and OPNAV community managers.

Strategic Business Partnerships

We have enlisted and teamed with two commercialization partners: Advanced Rotorcraft Technologies of Mt. View, CA, and Lockheed Martin Simulator Division of Albuquerque, NM.

Advanced Rotorcraft Technologies

Mr. Ron Duval, President of Advanced Rotorcraft Technologies (ART) has agreed to participate as a subcontractor in Phase II and to work with MSI to commercialize distanced PTT environments and software. With Phase I funding from MSI, ART developed an interface from the desktop PTT-like simulation program called PilotStation® to MSI's VTeamWare™ for web-based collaboration. PilotStation® was developed under a NAVAIR SBIR contract for NAWC-AD, Code 4.11. VTeamWare was developed under a NAVAIR SBIR contract for PMA299 (H-60). Both products are now in Phase III commercialization. By working together, ART and MSI form a great team to not only develop CPTT with PilotStation® but to move quickly to CPTT for other rotary winged aircraft (H-53, H-1, H-57, V-22, etc.) and simulators for other aircraft and aircraft components.

Lockheed Martin Simulator Systems Division

LMSSD is a leading supplier of high-level PTT systems used by the DoD, Department of Energy (DoE), and other organizations. LMSSD has headquarters in Orlando, FL, and their operation in Albuquerque, NM, develops hardware used as instructor workstations that interface to LMSSD full up simulators. By forming an alliance with LMSSD, we will be assured immediate access and interface to technology that is being developed for the next generation of training and simulation systems. LMSSD is interested in helping our project provide low cost niche Internet solutions that are not of sufficient interest to current projects, but which provide worthwhile low cost Partial Task Training solutions. In fact, use of CPTT will help in preparing students to make better use of full up simulator systems. LMSSD will consult in Phase II to assist in preparing for insertion into simulators and commercialization.

US Government Markets

There is a large market for PTT to support training and certification of government helicopters. The first market for our CPTT product environment will be the US H-60 users group that includes NAVAIR (Seahawks), the Coast Guard, the Army (Blackhawks), and Air Force. This represents the largest number of helicopters and therefore the largest number of PTT users. We estimate the combined H-60 markets will generate about $1M in combined revenues for software, network services, and upgrades. NAVAIR flies other rotary winged aircraft as do the other armed services. There are potential markets for Navy helicopters (H-53, H-57, V-22, and H1), Army helicopters (Apache, Longbow, etc.) and Air Force helicopters. Other US government agencies fly a variety of commercial helicopters.

Foreign Government Markets

There is a large and growing market for PTT in foreign governments that are major users of helicopters. The H-60 is widely used by the Australians, Spanish, Greek, Japanese, Singapore, Egyptian, and other nations. The H-60 alone represents a very significant opportunity to provide a US based Internet CPTT business that keeps foreign crewmen up to date on the latest flying procedures as taught at US facilities.

Commercial Markets

There are thousands of helicopter pilots employed by a wide variety of businesses around the world. Hundreds of pilots are employed in the oil industry. Several hundred other pilots are employed by state and local governments for law enforcement and outreach. The American Helicopter Society hosts an annual seminar and symposium that is an ideal place to market distanced helicopter flight instruction.

E-Commerce Strategy

Our strategy will be to market collaborative PTT as a web-based service for individual agencies and organizations. Initially we will focus on US Navy and Joint Forces requirements for distributed PTT capabilities. The e-commerce solution will provide a library of approved PTT scenario along with access to certified instructors to help with training issues. For example, there could be a web service for the US Navy and Navy reserves with specialty focus forums for H-60 helicopters, H1 helicopters, etc. Later, we see formation of a large number of web server sites that support various educational and training needs across a broad spectrum.

10. Points of Contact

The following lists persons we have contacted, and support further development in Phase II.

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